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METODOLOGÍA PARA LA ACTUALIZACIÓN DE COLECCIONES 3D ARQUEOLÓGICAS. DOS CASOS DE ESTUDIO PERTENECIENTES A LA NECRÓPOLIS DE QUBBET EL-HAWA (ASWAN, EGIPTO)

A METHOD AGAINST OBSOLESCENCE OF 3D ARCHAEOLOGICAL COLLECTION. TWO CASE OF STUDY FROM QUBBET EL-HAWA NECROPOLI (ASWAN, EGYPT) *

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RESUMEN

El presente artículo comparte la metodología necesaria para adquirir el acabado superficial hiperrealista en los modelos 3D escaneados por el proyecto Qubbet el-Hawa (Universidad de Jaén). Esta metodología significa el primer paso para el empleo de dichos modelos 3D como documentación arqueológica y como herramienta de difusión pública y educativa de los resultados del proyecto de investigación. El estudio presenta dos casos de estudio, hallados ambos en la tumba intacta QH34aa, un shabti de madera policromada y la máscara de cartonaje perteneciente a una dama llamada Satjjeni. Ambos casos de estudio han sido implementados en tres aplicaciones diferentes: como elementos insertos en fichas de catalogación arqueológica interactivas, como objetos expuestos de forma virtual (en espacio museográfico abierto online) y como reproducciones 3D a color (en experiencias expositivas multisensoriales). Ambos formatos, objeto virtual e impresión 3D, han sido la base de actividades con carácter puramente divulgativas o explícitamente educativas. Desarrollar la metodología adecuada ha permitido que los escaneados 3D que habían quedado obsoletos se hayan convertido en una documentación arqueológica actualizada que al mismo tiempo aumenta el potencial educativo de los resultados del proyecto Qubbet el-Hawa. Aquellos proyectos arqueológicos que dispongan de una colección de elementos digitalizados encontrarán en el presente artículo una metodología

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para su actualización y empleo como recurso divulgativo, objetivo primordial en proyectos vinculados a instituciones universitarias.

Palabras clave: 3DPDF, impresión 3D, Egiptología virtual, Necrópolis de Qubbet el-Hawa, Reino Medio, Asuán.

ABSTRACT

This article reports a validated method of acquiring texture for scanning´s output product achieved by Qubbet el-Hawa Project (University of Jaén). This method is the first step for the 3D model application as archaeological documentation and, furthermore, for its museology or educational use. The paper focused on two concrete case study recovered on intact tomb QH34aa, a polychrome wooden shabti, and, a cartonnage mask belonging to a lady. Both 3D model results had been implemented in those three applications, they are inserted in an archaeological 3D catalogue and they were part of dissemination and educational programs thanks to its virtual version and to its 3D coloured printed version. First one were displayed in online platform and second one were displayed in real multisensory experiences. Finding the right methodology, obsolescence 3D models have become an updated and consolidated archaeological documentation of QH34aa tomb cultural material, whereas Qubbet el-Hawa project have been actualized the educational potential of its research results. In order to update its 3D model collection this developed method can be used by others archaeological research project, especially, those projects belonging to universities in which the dissemination of work is a fundamental challenge.

Key words: 3DPDF, 3D printed, Virtual Egyptology, Qubbet el-Hawa necropolis, Aswan.

1. INTRODUCCIÓN

Nowadays archaeological projects consider geomatics tools as an innovative but necessary device, therefore, a 3d catalogue for its graphic documentation was necessary for QH34aa tomb archaeological excavation report[1]. Unfortunately, the laser scanner used

[1] Castro et al., 2016: 319-335; Hassani, 2015: 207-214; Kimbal, 2016: 61-62; Perez-García, 2018: 121-135; Rabinowitz, 2015: 27-43.

did not create the photorealistic texture. We had to undergo our own research about a complementary software to achieve a complete hyper realistic 3D model of each archaeological artefact scanned. The next goal of this study has to do with database storage 3D files[2], we achieved a proper workflow to create a 3DPDF catalogue worksheet that allows to obtain precise measurements, volume calculations and cross section mappings of those case studies.

Results presented focus on two concrete case studies, a polychrome wooden figure (shabti) and a cartonnage mask belonging to a lady, recovered on intact tomb 34aa sited in Qubbet el-Hawa necropolis. Their modelling workflow strictly follows the Principles of Seville Letter (www.smartheritage.com/Seville-principles) and the London Chapter (www.londoncharter.org) to avoid authenticity, historical strictness or fidelity confusions during our virtual 3d model experiences[3]. Some milestones have occurred in Virtual Archaeology to mark the guidelines of action that ensure historical rigor during its practice. First effort to define and specifically create a list of norms appeared in 1991 when Reilly published his article, "Towards a virtual archaeology". Europe 2001 Action Plan pushes up virtual practice to develop cultural heritage conservation and public diffusion. In 2009, recommendations and principles for implementation, aims and methods, research sources, documentation, sustainability and accessibility best practices for virtual archaeology were recompiled in London Charter. Finally, the First International Congress on Archaeology, Computer Graphics, Cultural Heritage and Innovation was celebrated in Seville in 2009. Its results were definitely published in 2012 as a set of principles for the technically and intellectually use of new technology in Virtual Archaeology, "Principles of Seville" [4].

There are several areas whereby new technology has developed and expanded at archaeological works. First one, in the field documentation work, specifically in the registration of the different levels, substratum or stratigraphy. Also in surfaces analyses works like research on engravings, inscriptions or prospection. One of the most successful, in which this study is focused on, is the 3D recording of small objects and its subsequent use for public dissemination projects. Its use as independent graphic archaeological record is currently in standardization progress. Some authors defend that

[2] Nimmo and Mckeague, 2016: 239-249; Wittur, 2013: 219-251.
[3] Hermon, Niccoluci, 2018: 37-47; Rabinowitz, 2015: 27-43.
[4] Grande, Lopez-Menchero, 2012: 29-32.

3D records will replace classic drawing, that's not our opinion[5]. We believe both forms of archaeological documentation are destined to combine possibilities and advantages in a single set.

1.1. The necropolis of qubbet el-hawa (aswan, egypt). Tomb 34aa.

Qubbet el-Hawa is situated on a hill in front of the modern town of Aswan, originally it was the necropolis of the high officials of Elephantine[6] . Since the end of the 6th to the end of the 12th Dynasty, Qubbet el-Hawa was the necropolis where the highest local officials were buried. During the succeeding periods up to the 5th century, different lower officials and common people were buried in smaller tombs or used earlier tombs to be buried. The tombs of the highest officials basically consist of monumental funerary complexes constructed on the hill, being one of the best examples of the ancient Egyptian hypogea.

During the second half of the 12th Dinasty, the governors of Elephantine together with other members of the local elite were buried in part of the southeast side of the hill[7]. This area was originally divided into two zones, south and north. The QH34aa tomb (findspot in which case studies were found), is sited at the north part.

The southernmost part was occupied by three funerary complexes where the governors constructed monumental hypogea: QH32 (Khema), QH31 (Sarenput II) and QH33 (Heqaib-ank and Heqaib III). Beside these complexes, in the north part, smaller tombs were constructed for different members of the elite: QH34 (Late 12th Dynasty/13th Dynasty), QH34aa (contemporary to QH33) and QH34bb (contemporary to Khema and Sarenput II)[8]. Two funerary chambers (QH34aa and chamber 5 in QH34bb) were found intact during the recent archaeological excavations carried out by the University of Jaén (2014-2018)[9]. The one we are studying, QH34aa, consisted of a small tomb, which today only shows part of its original structure: the inner part of the chapel, where it begins a deep shaft of nine meters. At the bottom of the shaft, there was a burial chamber, where ten individuals were buried during the reign of Amenmehat III (1818- 1773 BC)[10] .

[5] Gilboa et al., 2013: 1329-1339.
[6] Elmar, 1972.
[7] Martínez-Hermoso et al., 2018: 25-44.
[8] Jiménez-Serrano, 2017: 13-109.
[9] Jiménez-Serrano et al., 2014: 7-48; Jiménez-Serrano et al., 2017: 13-109.
[10] Jiménez-Serrano et al. 2017: 13–109.

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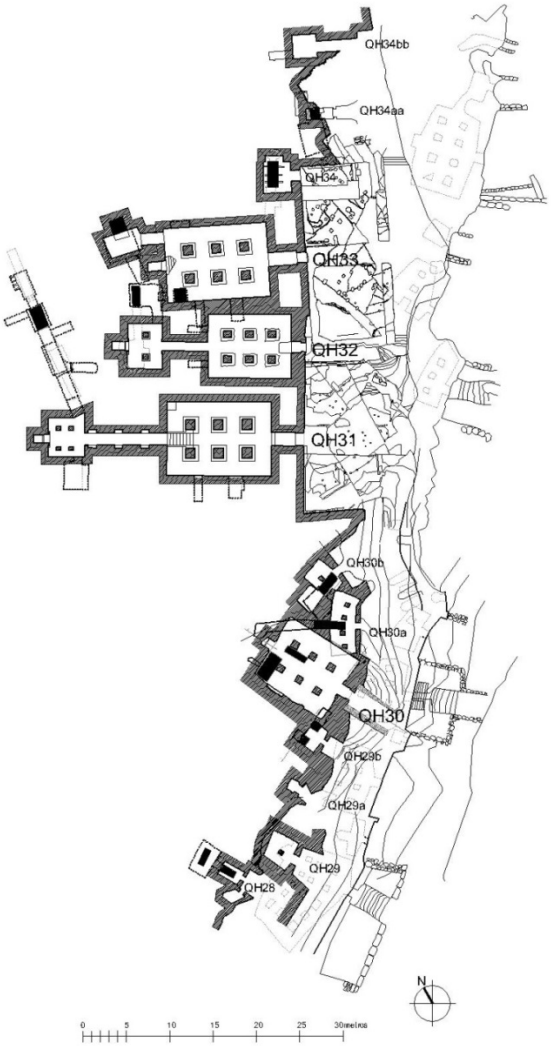

Figure 1. Tombs in the necropolis of Qubbet el-Hawa. South-West terrace. Author : J. A. Martínez-Hermoso C Qubbet el- Hawa project.

The multiple burials (five women, four men and one infant female) were carried out in a short period of time, perhaps during a couple of decades. All of them were interred in decorated wooden coffins, some of them made of imported cedar wood [11]. In the late 12th Dynasty burials, the funerary equipment decreased compared with earlier elite burials. That might be the explanation of why not many grave goods were found in the funerary chamber[12]. It might be also possible that the funerary equipment was deposited in the upper level of the tomb, today disappeared.

[11] Jiménez-Serrano et al. 2017: 13–109.
[12] García-González, Jiménez-Serrano, 2018: 15-23.

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Case study one is the cartonnage mask belonging to individual 1. Its owner was a woman buried in a coffin were was identified as Sattejni (A). The mummy was buried in a double set of rectangular coffins and was covered by cartonnage shroud in the face, the chest and the pelvis[13]. The cartonnage in the face is our first case study. Only the mask had enough conservation quality to be digitalized, since its yellow-painted skin content arsenic rest and it denied insect to eat the wood. Second case study, the shabti, was part of individual 8 equipment, its coffin was buried during a later occupied phase than individual 1. Individual 8 was an old woman who was buried in a very bad condition from which only some decoration fragments and the udyat have been recovered. Inside appeared a shabti set which included its own coffin, some stones and faience beads. The shabti figure is our second case study. The stones and faience beads may have been a fishnet shroud and a necklace or collar with amulets[14].

Figure 2. Hieroglyphic inscription digitized from the orthophoto of shabti´s 3d model. Author: L. Serrano-Lara.

Although the burial belonged to a woman, the shabti present an inscription identified as Sarenput, son of a woman named Neferet-Hesw, being perhaps the name of the deceased. The transcription obtained by the transliteration word font of this hieroglyphic inscription said: "The venerated before Osiris Sa-renput, begotten by Neferet-Hesu"[15].

[13] Jiménez-Serrano et al. 2017: 13–109.
[14] García-González, Jiménez-Serrano, 2018: 15-23.
[15] García-González, Jiménez-Serrano, 2018: 15-23.

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Both 3D model cases studies allow researchers to understand different time periods of occupation in the intact funerary chamber belonging to QH34aa tomb. Therefore, researchers can study changes happened in burial customs during the mid-late Middle Kingdom.

Figure 3. Entrance of tombs QH34aa and QH34bb during 2017 campaign excavation. C Qubbet el-Hawa project.

2. METHODOLOGY TO IMPROVE ARCHAEOLOGICAL 3D DOCUMENTATION

The main aim of the workflow developed is the high quality of the 3D graphic documentation. The calibration reliability of our laser scanner is the first step, it has to be fixed in relation to the size of the archaeological object to be scanned, in order to obtain the maximum accuracy of its virtual reproduction. During present study is being used a structured-light scanner (HDI Advance Model R3 from LMI). To create the 3D model is necessary to post-process the different shots provided by acquisition sensor. Geomagic Design (software appertain to the scanner itself) allows the post-process which create the geometric mesh of the model from its dense cloud of points. At this point, due to the metric conditions of its virtual artefact, it has special importance to export X, Y, Z coordinates to the 3D model on the maxim level of precision. The scanner reaches a

precision of twenty microns. Thus, the original artefact completely corresponds to its 3D replica.

Next step meaning one of the biggest challenges during this study owing to the pre-existing problems implementing the texture in the scanned product. Texture must be understood as the colour and a final surface of the real artefacts, also defined as a mapping[16] . The complete workflow has been achieved thanks to 3D Coat software which allow the texture inclusion in the geometry object through photographs.

This hyper realistic complete 3D model, finally, can be part of an interactive high-quality archaeological catalogue. It can be used as a scientific tool for research or for public dissemination to the QH34aa tomb´s cultural material. The interactive 3D catalogue has to be a type of autonomous format capable of providing 3D graphic documentation for online applications users. Inserting 3D model inside this autonomous format was the next challenge in the present study.

We had tested the methodology carried out by different projects and institutions,[17] which recommended to export the 3D model into the file format *U3D o *prc, as the accepted formats to be embedded in a PDF document. Since 3D Coat software does not create those kind of format we had to achieve the proper method to convert a *STL native format into a capable one to maintain each colour vector. *PLY format was the solution and its characteristic was also useful for others types of public broadcast applications as, for example, the one used in our Virtual Museum which will be analyzed in the corresponding section.

To collaborate with those archaeological projects that needed to implement their digitized models as a 3D catalogue, we will summarize our workflow to convert a coloured vector 3D model into the *prc requested format. First, thanks to Geomagic Design software, it is possible to produce the appropriated mapping in UV mode, by the texture map manager´s tool this software allows us to apply the linear Mipmap filter into the 3D model. In this filter the graphic card will calculate an interpolation of the closest 4 pixels around one coordinate, therefore, a linear blend of those 4 pixels appears as a texture achieved on the polygonal mesh. Owing to this conversion (when we export our model into a *prc format), it will keep its texture even when it is inserted in a 3DPDF.

[16] Balleti et al., 2018: 55-62; Felicísimo et al., 2014: 13-18.
[17] Martinez, 2016; Felicísimo et al., 2014: 13-18.

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Researchers can carry out a detailed analysis of the artefact by using interactive document, PDF format include some others advantages, indeed. A tool for selective measurements could be performed without a number of times limit or spatial limit. Furthermore, users will have the possibility of making an unlimited kind of sections from different perspectives and positions. It was, therefore, essential to implement the methodology to create a 3DPDF working as an archaeological worksheet.

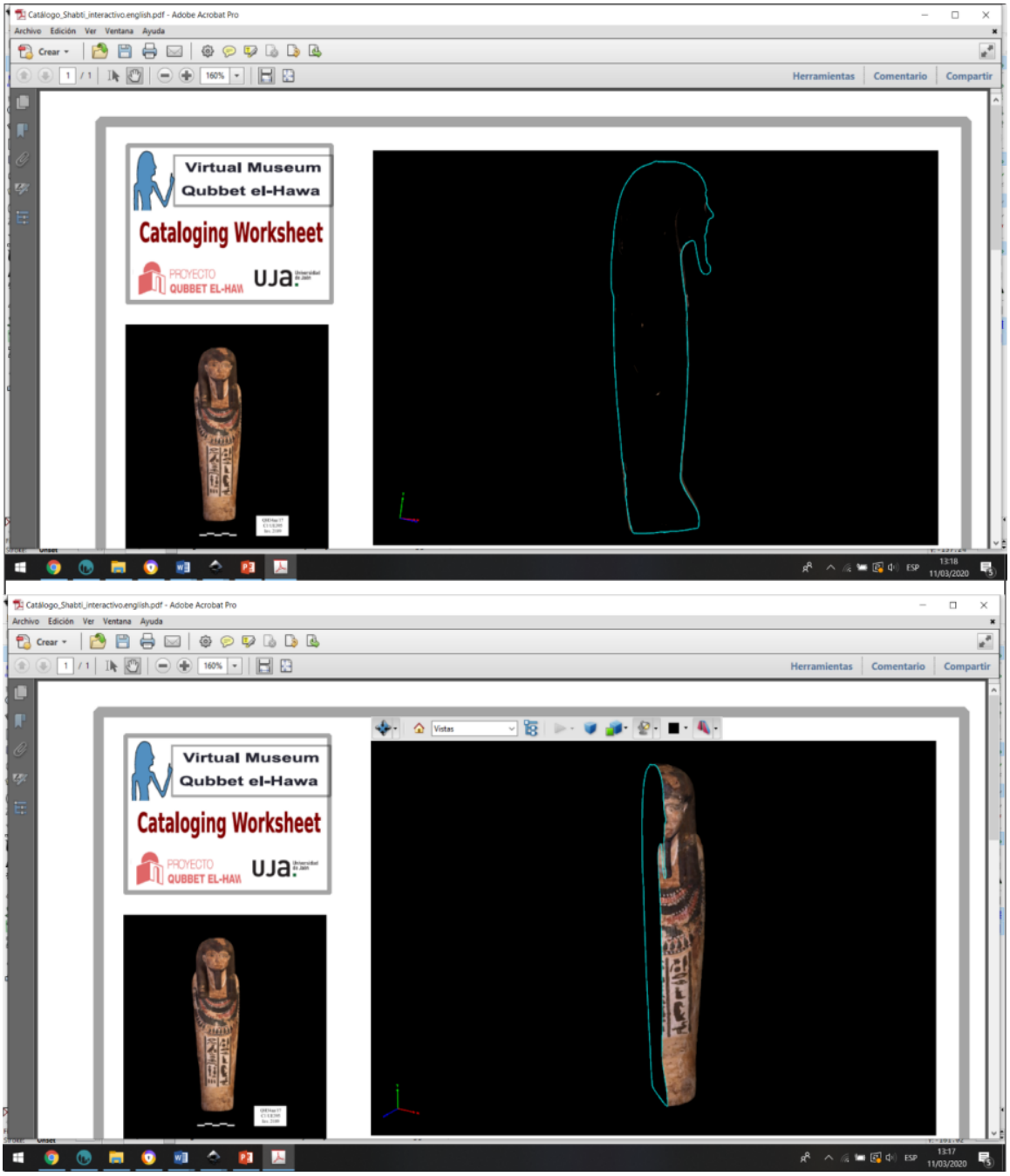

Figure 4. Section obtained in the shabti 3D model using the 3DPDF worksheet tools.

Virtualization of archaeological objects allows their subsequence 3D printing and therefore, a wide range of possibilities for public dissemination[18]. Our colourful 3D model allows the most hyper-realistic 3D printed since our specific printer project the colour to paint the texture of the replica which has been printed in layers of composite (material).

3. DISCCUSION AND RESULTS

Results obtained in 3D models applications for Qubbet el- Hawa Project research has been our achievements. Two first related to public dissemination and education programs. The last one relates to academic applications as archaeological documentation itself thanks to the implementation of a three-dimensional catalogue.

3.1. Public dissemination activities and educational projects: postmodern achievement.

Public dissemination is considered a main goal in the sciences of humanities. In order to display the results of research group HUM-458 Egyptology and papyrology, belonging to the University of Jaén, it was created the exhibition named "Ancient Egypt in your hand". This exhibition was part of the activities for the European Researcher´s Night 2019-2020.

The main goal in this multisensory exhibition was to allow visitors to enjoy themselves 3D printed reproductions. So they have access to archaeological artefacts which, otherwise, they could only contemplate travelling to Egypt. Moreover, physical interaction, generally forbidden in museum institutions, is allowed with 3D printed artefact.

Many surveys have demonstrated that physical interaction with objects during an exhibition increase the learning capacity as well as there is a high connection between multisensory experience and memory retention. Moreover, visitors enjoy a touchable exhibition in a greater degree than media display, visitors felt closer to objects due to the possibility to depth investigate its details. To create a multisensory exhibition is an achievement in itself, however, most important was to provide the possibility for visually impaired visitors to engage with history through this experience. Visitors assume the

[18] Balleti et al., 2018: 55-62; D´Agnano et al., 2015: 207-213; Eric et al., 2013: 01-253; Kotoula, 2009: 433-446; Mc Ginnis, 2014: 331-340; Moens, 2018: 68-79.

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breaking of barriers about the dissemination of theoretical content by using tools ranging from the Braille system to the virtual environment which could be considered an achievement itself. It must be mentioned the collaboration of the Spanish National Organization of the Blind (ONCE) which have been transcribed all artefact's signs into a braille system for visually impaired users.

Figure 5. Sarentput´s shabti 3d printed reproduction display next to the brail and text signs.

Our exhibition achieved the postmodern museum´s aims[19] while the key artefact keeps preserved from risk. To preserve the original object become a hypothetical theory for the present survey since objects wouldn´t be exhibited in Spain. Nevertheless, printed surrogate´s open an accessible window for those who recognize the cultural heritage through tactile experience.

[19] D'Angelo et al., 2015: 207-213; Eardely et al., 2016: 263-286; Wilson et al.; 2017: 445-465.

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Figure 6. Alejandro Jiménez, director of Qubbet el-Hawa project, guiding BPS visitors during "Ancient Egypt in your hand" experience.

Natural application to both experiences (virtual museum and 3D printed replicas exhibition) is educational projects. The Science and Diffusion Unit of the University of Jaén carries out different research groups of the institution. In 2019 the Department of Geography, Anthropology and History proposes an activity called “Virtual Egyptologists”. During one week more than 300 high school students participate in these activities that allowed them to carry out their own research based on the virtual labels and historical information present in each 3D artefact reproduction exhibited in the Qubbet el-Hawa Virtual Museum. The experience was especially motivating for allowing them to approach History through new technologies, receiving a pleasant response from the students themselves.

The classroom was previously divided into groups, they had to fill themselves five worksheets. The worksheets from all groups together configure a set so, beyond the experience, this set will be an archaeology catalogue for the classroom. Them, a representative student of each group hold a 3D printed replica. They shared all the data learned by filling the cataloguing sheet during the previously working team.

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Figure 7. Student holding the 3D printed artefact in order to impart a lesson about it during "Virtual Egyptologist" experience.

Specialized literature defends that students generates new knowledge in a higher degree of permanence due different ways of the data purchase. It allows deeper links between conclusions and in consequence it generates a long memory about knowledge[20]. Indeed, our student had increased their interest in the results achieved by Qubbet el-Hawa project carried out by University of Jaén team.

3.2. 3D Archaeological cataloguing and data base applications.

Qubbet el-Hawa database was implemented to manage the whole material evidence found by the team of the University of Jaén during the last ten archaeological season. The database final proposal is to create a virtual structure to facilitate the search of all graphic documentation of each singular artefact. Furthermore, it is a library for researchers from the project team itself as well as for the externals one that request it.

[20] Castro, 2017: 33–40; Khunti, 2018: 1-12; Mortiz et al., 2014: 135-142; Sportum, 2014: 331-341; Wilson et al., 2017: 445-465.

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To implement a specific file which display 3D models it is not possible at the moment. Nevertheless, we have achieved a standard WebGL capable to link with the specific space of each 3D model from Qubbet el-Hawa Virtual Museum.

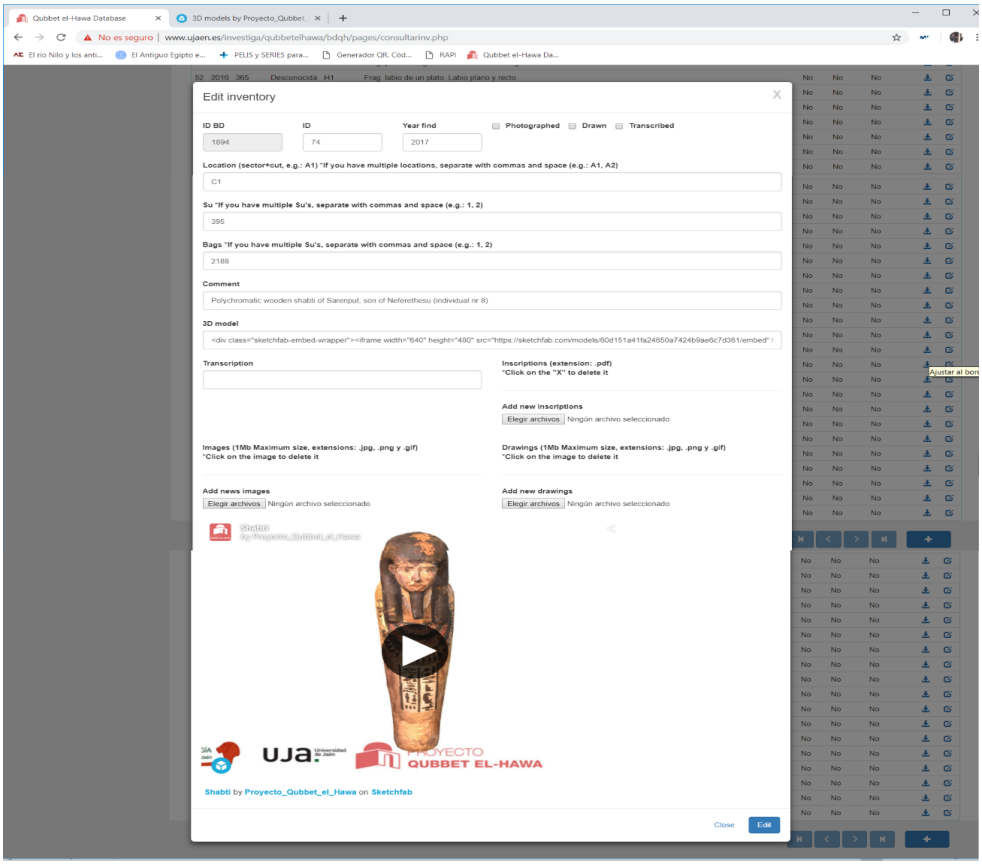

Figure 8. 3D model linked to its database item. Case study nº 2, Sarenput´s shabti.

To create an interactive catalogue, we have chosen 3D PDF format complied with the ISO 24517-1:2008 standard. It has become the new international standard for exchanging technical documents, regardless of CAD tool used to create the original 3D model.

Most interesting characteristics on 3DPDFs used as interactive catalogues are their compatibility with the totally of reading software and its possibilities of importing the native file from most formats (STL, OBJ, PLY…). Another great advantage is the possibility of presenting the work in layers performing a differentiated analyze according to the significant element that we wish to analyse, either the texture or the encoded metadata linked to the model. Moreover, one of the most relevant applications for the

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study of archaeological materials is the measurements derived from itself, thanks to the fact that the 3D model includes coordinates that pdf format application will translate into millimetres. Equally important for archaeological research is the fact of interactive catalogue worksheet allows the realization of sections in X, Y, and Z in an unlimited way.

A QR code was inserted into the 3DPDF document to create a direct link to the 3D artifact displayed in Qubbet el-Hawa Virtual Museum (https://sketchfab.com/Proyecto_Qubbet_el_Hawa/models). Furthermore, QR codes were included during 3D printed replicas exhibition, offering deep knowledge of each artifact thanks to the aforementioned link.

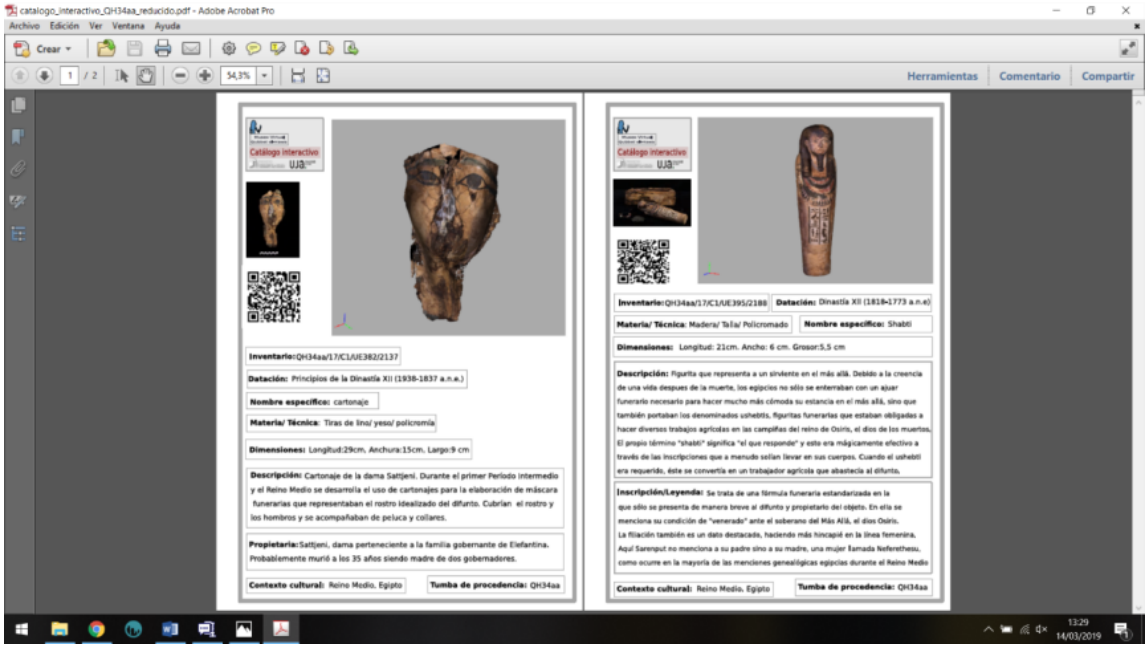

Figure 9. Interactive worksheet of archaeological catalogue for both case studies, 3DPDF document.

3.3. Archaeological knowledge generated in visitors through case studies.

Both paper's case studies, Satjjeni A's cartonnage mask and Sarepunt shabti had become an interacting digitally object in two applications for archaeological research. First one, as an archaeological documentation itself. 3DPDF catalogue produces a much greater measurements and sections quality, furthermore, it creates the possibility to carry out an approach at the extreme level of detail. Second one, as part of either dissemination or educational experiences.

Though just second case study could be three-dimensional printed, the connection between visitors and both artefacts had been increased due to their interaction in Qubbet el-Hawa Virtual Museum. Thus, both 3D virtual reproductions contribute to the fulfilment of the educational potential.

Artefacts reproductions by 3D printed allow plenty of possibilities as a tactile educational experience, indeed, it allow the opposite experience relative to the don´t touch common rule in museums. Regardless accuracy on 3D replicas it is necessary to provide complementary historical content to achieve a successful dissemination experience. An interactive experience could be frustrating for visitors if its expectation about to understand the research data don´t be supplied[21].

Taken this premise into consideration, we mesh archaeological and historical data as a floating label on the 3D model virtually exhibited. Also offering the necropolis site map to show the specific findspot of each artefact. Visitors could deep into archaeological cataloguing data depending on their personal interest. For case studies, visitors must be contextualized in the tomb QH34aa. Latest research results carried out by Qubbet el-Hawa Project defines the specific characteristics of third stage of burials. This stage present individual burials with a rectangular shape and bodies accompanied by cartonnage funerary mask, while second phase offers double sarcophagus without hieroglyphic inscriptions. Our first case study, Sattjeni A mask is classified in the second phase[22]. Therefore, through the following object study, we can teach the evolution of the different stages of use in the entire necropolis of ancient Elephantine. Student or virtual visitor who access to the virtual reproduction will better remember the characteristics of Sattjeni´s mask (yellow colour of the face, the shape of the eyes, the detail on the forehead), while they will link those morphological data with archaeological knowledge itself. Users will remember that the burial of this woman belongs to the second phase of use of the tomb, since she was the second individual to be buried in the same space, and, in addition, the student will remember that this burial occurred during the XII Dynasty, during the reign of Amenemhat III (1850-1810 a.n.e.). Thus, the Middle Kingdom will be placed in the student or visitor´s temporal line for the study of Ancient Egypt.

[21] Martínez-Hermoso et al., 2018: 25-44; Pescarin, 2014b: 131-140.
[22] García-González and Jiménez-Serrano, 2018: 15-23; Jiménez-Serrano et al., 2014: 7-48; Jiménez-Serrano, Sánchez-León, 2016: 5-13; Pérez-García et al., 2018: 121-135.

Second paper´s case study, the shabti belonging to Sarenput son of Neferethesu, is classified during the third phase following the whole necropolis burial typology. During disseminations activities the students (once had filled the QH34aa tomb localization on the necropolis map) could be along with the sculpture 3D printed reproduced held in their hands. Then, they could imagine this shabti belonging to a Middle Kingdom funerary ritual in the Qubbet el-Hawa necropolis. They felt the possibility of held an Ancient Egyptian history´s puzzle piece, specifically a piece in the process of bodies depositions in the QH34aa tomb grave[23].

Interaction with 3D replicas (as a virtual model or as a printed object) create a type of link to the archaeological element that has a positive chain effect[24]. For instance, they allow the simultaneous connection with historical data, such as the constructive phases in the tomb studied.

4. CONCLUSIONS

3D digitization of archaeological remains has been standardized in current research. Thanks to workflow developed, to share an archaeological virtual collection between institutions and organizations become a fact. In addition to advantages belonging to scan technique as a non-contact procedure, this paper demonstrates how useful is 3DPDF as an archaeological documentation which provides new applications like the highest accuracy measurements and shape´s surveys. As annex at the end of this paper both case studies cataloguing sheets in 3DPDF are provided.

Our greatest achievement has been to obtain a methodology for the inclusion of texture in scanned models and the possibility of including them in the 3DPDF format. Following international current principles of authenticity and transparency for Virtual Archaeology we have been updating Qubbet el-Hawa 3D collection since we have been assumed digital technologies as a necessary tool for archaeological research.

New access and engagement between visitors or researchers and artefacts is a responsibility of a virtual archaeologist who must convey the belonging of the 3D model

[23] García-Gómez, Jiménez-Serrano, 2018: 15-23; Jiménez-Serrano et al., 2017: 13-109.
[24] López-Rodríguez and Serrano-Lara, 2016: 249-266; Mortiz et al., 2014: 135-142; Serain, 2018: 95-105; Sportum, 2014: 331-341; Wilson et al., 2017: 445-465.

to a specific historical space-time context. In order to create a reliable tool to access and learn about the cultural material each item exhibited should offer historical references. We design an index of content, including specific historical space-time data, archaeological site data, topographic maps, bibliographical references and parallels to create a scientific explanation of the 3D model. Thus, interaction with 3D model allows to learn historical references about Qubbet el-Hawa project research results.

Both interactive experiences (virtual museum and printed model) has received a high positive feedback from professors and students, therefore, the shared procedure will be used in future archaeological campaign workflow of artefacts digitalization.

In conclusion, this study has verified a method to actualize the 3D collection, thanks to postmodern graphic documentation´s characteristic of current archaeological research. This validated method can be used in other projects that need to update its three-dimensional scanner collection, especially those projects belonging to universities where public dissemination results is a fundamental challenge. Our further project, taken in consideration previously success in multisensory and virtual activities, will focus on placing cultural material digitized in its original architectural context, as a modelled historical recreation of the necropolis burial chambers.

5. APPENDICES

Both case studies ´s archaeological worksheet has been annexed as 3DPDF document.

6. ACKNOWLEDGMENT

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